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(57)Abstract:
PROBLEM TO BE SOLVED: To provide a movement detecting circuit by which the movement of a picture where patterns coincide between frames is detected, a still part having a vertical high frequency component is prevented from being erroneously judged to be the movement and the movement is correctly detected.
SOLUTION: An inter-frame movement detecting signal d02 is delayed by field memories 23-25 to obtain signals d13, d24 and d35. An inter-frame movement detecting signal d01 is inputted to a maximum value detecting circuit 51 via a switch 41. The circuit 51 detects a maximum value by the signals d02, d13 and a signal d01s being the output of the switch 41 and generates a movement detecting signal k. The switch 41 is turned on when the signals d24 and d35 exist and turned off unless they exist.

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<HR>CLAIMS

<HR>[Claim(s)]

[Claim 1]

In the motion detector which detects the motion in the video signal of interlace, moves, and generates a detecting signal
An inter-frame motion detecting-signal generation means to generate an inter-frame motion detecting signal by taking the 1 inter-frame difference of said video signal,
A field motion detecting-signal generation means to generate a field motion detecting signal by taking the difference between 1 fields of said video signal,
A delay inter-frame motion detecting-signal generation means to generate the delay inter-frame motion detecting signal which is equivalent to the signal delayed one or more frames in the direction of time amount in said inter-frame motion detecting signal,
A motion detecting-signal generation means to generate a final motion detecting signal using said inter-frame motion detecting signal and said field motion detecting signal at least,
a ****** [using said field motion detecting signal based on said delay inter-frame motion detecting signal] -- or the motion detector characterized by having and constituting the control means which controls extent using said field motion detecting signal.

[Claim 2]

Said control means is a motion detector according to claim 1 characterized by being the switch which turns on and off the output to said motion detecting-signal generation means of said field motion detecting signal.

[Claim 3]

Said control means is a motion detector according to claim 1 characterized by being the sensibility control circuit which adjusts the sensibility of said field motion detecting signal.

[Claim 4]

Said control means is a motion detector according to claim 1 characterized by being the perpendicular low pass filter which adjusts bandwidth in case said field motion detecting signal is generated.

<HR>DETAILED DESCRIPTION
<HR>[Detailed Description of the Invention]

[0001]

[Field of the Invention]

This invention relates to the motion detector which detects a motion of an image, and as an example, in case it generates a scanning-line interpolation signal in the equipment which changes the interlace signal of NTSC system or a HDTV method into a non-interlaced signal (formation of double dense), it relates to the motion detector which generates the motion detecting signal needed in order to switch the interpolation approach accommodative by the motion part and stationary part of an image.

[0002]

[Description of the Prior Art]

There is a scanning-line inverter which changes interlace signals, such as an NTSC signal and a HDTV signal, into a non-interlaced signal using a field memory.
When changing an interlace signal into a non-interlaced signal, the image of the adjoining field is interpolated in the part by which the image is standing it still, what equalized vertical Rhine in the same field into the part by which the image is running is interpolated, and general technique interpolates the scanning line.
If it does in this way, while being able to prevent the Rhine flicker of a stationary part, vertical definition will increase and the twin image active jamming

of a motion part of it will be lost.

[0003]

In the scanning-line conversion by such motion adaptation processing, the judgment of the part by which the image is running, and a stationary part, i.e., a motion detector, is needed.
It is indicated by the patent No. 2642846 official report, JP,5-300541,A, etc. as an example of a motion detector.
Generally, a motion detector has two approaches, the inter-frame motion detection based on 1 inter-frame difference, and the field motion detection based on the difference between 1 fields.

[0004]

[Problem(s) to be Solved by the Invention]

Since the sample point is completely in agreement in inter-frame motion detection, moving accidentally and judging a stationary part except for the effect of a noise etc., to be a part has the advantage that there is almost nothing.
However, detecting a motion of an image whose pattern corresponds with 1 frame period has the fault of being impossible.
On the other hand, in field motion detection, there is an advantage which can detect a motion of an image whose pattern corresponds with 1 frame period.
However, since the sample point for taking difference is not in agreement, there is a fault of judging the stationary part which has a perpendicular high-frequency component to be a motion.

[0005]

It aims at offering the motion detector which cannot judge accidentally the stationary part which this invention is made in view of such a trouble, and can detect a motion of the image whose pattern corresponds by inter-frame, and has a perpendicular high-frequency component to be a motion, and can detect a motion correctly.

[0006]

[Means for Solving the Problem]

In the motion detector which detects the motion in the video signal of interlace, moves, and generates a detecting signal in order that this invention may solve the technical problem of a Prior art mentioned above
An inter-frame motion detecting-signal generation means to generate an inter-frame motion detecting signal by taking the 1 inter-frame difference of said video signal (11, 12, 21, 22),
A field motion detecting-signal generation means to generate a field motion detecting signal by taking the difference between 1 fields of said video signal (11, 13, 14, 31, 32),
A delay inter-frame motion detecting-signal generation means to generate the delay inter-frame motion detecting signal which is equivalent to the signal delayed one or more frames in the direction of time amount in said inter-frame motion detecting signal (23-25),
A motion detecting-signal generation means to generate a final motion detecting signal using said inter-frame motion detecting signal and said field motion detecting signal at least (51),
a ****** [using said field motion detecting signal based on said delay inter-frame motion detecting signal] -- or
The motion detector characterized by having and constituting the control means (41, 42, 33) which controls extent using said field motion detecting signal is offered.

[0007]

[Embodiment of the Invention]

Hereafter, the motion detector of this invention is explained with reference to an accompanying drawing.
Drawing for the block diagram in which

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shows the 1st example of the motion detector of this invention, and
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to explain actuation of the motion detector of this invention, the block diagram in which
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are the block diagrams showing the 5th example of the motion detector of this invention.
In addition, in
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, the same sign is given to the same part as
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, and explanation is omitted suitably.

[0008]

In <1st example>
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, the video signal s0 which is an interlace signal is inputted into an input terminal 1.
The 1 field of signals s0 is delayed by field memories 11 and 12, respectively, from a field memory 11, a signal s1 is outputted and a signal s2 is outputted from a field memory 12.
When the inputted video signal is 1125 number-of-scanning-lines interlace, the amount of delay by the field memory 11 makes 563 lines the amount of delay by 562 lines and the field memory 12.

[0009]

A subtractor 21 subtracts the signal s0 which is a signal of the current field, and the signal s2 which is a signal delayed one frame, and an absolute-value circuit 22 absolute-value-izes the output of a subtractor 21, and outputs a signal d02.
Thereby, a 1 inter-frame motion is detected.
The average circuit 14 average-izes signal s1d delayed one line by the Rhine memory 13 in a signal s1 and this signal s1, and outputs signal s1a.
A subtractor 31 subtracts a signal s0 and signal s1a, and an absolute-value circuit 32 absolute-value-izes the output of a subtractor 31, and outputs a signal d01.
Thereby, the motion between 1 fields is detected.
A signal d01 is inputted into a switch 41.

[0010]

Since the signal d02 which is an inter-frame motion detecting signal has taken difference in the condition that the sample point is in agreement, as mentioned above, it does not judge a stationary part as a motion accidentally.
However, since the sample point of the signal d01 which is a field motion detecting signal does not correspond, the difference of what equalized the signal of the current field and the signal of the Rhine up and down shifted is taken, and a stationary part may be judged accidentally to be a motion.

[0011]

Then, in this invention, when it is owner values (motion judging) whether they are the signal d24 which delayed one inter-frame motion detecting signal d02 by field memories 23 and 24, or the signal d35 to which 1 field delay (delayed the 3 field to a signal d02) of this was further carried out by the field memory 25, it controls to turn ON a switch 41 and to let the field motion detecting signal d01 pass.
It controls so that in the case of 0 (quiescence judging) all of signals d24 and d35 turn OFF a switch 41 and do not let the field motion detecting signal d01 pass.

[0012]

The inter-frame motion detecting signal d02, the signal d13 delayed by the field memory 23 the 1 field in this signal, and signal d01s outputted from the switch 41 are inputted into the maximum detector 51.
this signal d01s -- above -- the on-off control of a switch 41 -- the field motion detecting signal d01 -- it may remain as it is and there is also a case of a non-signal (0).
The maximum detector 51 detects these signals d02 and d13 and d01s maximum, and outputs the thing of the maximum as a final motion detecting signal k.
The motion detecting signal k is outputted from an output terminal 100.
The inputted signal may be mixed instead of the maximum detector 51, and the final motion detecting signal k may be outputted.
In this case, the mixed method is arbitrary.

[0013]

Here, actuation of
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is further explained to a detail using
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-- setting -- (a) -- in the image of one frame ago, and (d), the image in front of 3 fields and (e) show the image of two frames ago, and, as for the image of the field, and (b), (f) shows [the image in front of 1 field, and (c)] the signal of the image in front of 5 fields now, respectively.
Moreover, (g), (h), (i), and (j) show the inter-frame motion detecting signals d02, d13, d24, and d35, respectively.
Moreover, in (l), (m) shows the final motion detecting signal k for motion detecting-signal d01s between the fields where (k) received control for the field motion detecting signal d01 with a switch 41.

[0014]

In this example, since the pattern of the body A before [one] being shown in Body B and
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(c) of the present field shown in
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(a) is in agreement, as shown in
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(g), the wavy line part which should be judged in the inter-frame motion detecting signal d02 to be a motion is not detected.
On the other hand, as shown in
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(k), in the field motion detecting signal d01, it is detected as a motion.
However, in the field motion detecting signal d01, since a stationary part may also be judged as a motion, it is not desirable to use it as it is.

[0015]

Furthermore, in this example, the case where Body C includes the perpendicular high-frequency component is assumed.
In this case, although Body C is standing it still, as shown in
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TARGET="tjitemdrw">drawing 2</A>
(k), the field motion detecting signal d01 will appear.

[0016]

Then, in this invention, only when 3 field delay of the inter-frame motion detecting signal d02 is made to carry out in the temporal (time amount) direction the 2 fields and these delayed inter-frame motion detecting signals d24 and d35 are judged as a motion, it controls to let the field motion detecting signal d01 pass, and motion detecting-signal d01s is obtained between the fields.
And between this field, the maximum (or blending value) of motion detecting-signal d01s and the inter-frame motion detecting signals d02 and d13 can be judged as an animation, also when it is the final motion detecting signal k, then the image whose pattern corresponds by inter-frame.
In addition, when two or more same bodies moved to coincidence as an example whose pattern corresponds, the striped image may have moved.

[0017]

In the example of
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TARGET="tjitemdrw">drawing 2</A>
, among the motion detecting signals k shown in (m), the motion detection in the location of p0, p1, p4, and p5 is motion detection based on inter-frame difference, and the motion detection in the location of p2 and p3 is motion detection based on the difference between the fields.
In order for the image of the current field and the image delayed the 1 field to generate a still picture as scanning-line interpolation in the case of performing conversion to a non-interlaced signal, it is required to move in the location of p0-p3 at worst, and to make detection.
In this example, the motion is detected in the indispensable location of p0-p3.
Moreover, although the difference between the fields had appeared from the first in the location of p6, the motion detection which was mistaken with this invention is oppressed.

[0018]

A signal d13 is inputted into the maximum detector 51 for detecting a motion also in the location of p1.
Although it is a desirable operation gestalt, using a signal d13, although the motion detecting signal k is generated may input only a signal d02 and d01s into the maximum detector 51 depending on the case, and it may generate the motion detecting signal k.

[0019]

In the 2nd example shown in <2nd example>
<A
HREF="http://www4.ipdl.inpit.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww4.ipdl.inpit.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3C%3D%3D%3C66%3A%2F%2F%2F%26N0001%3D622%26N0552%3D9%26N0553%3D000005"
TARGET="tjitemdrw">drawing 3</A>
, a different point from
<A
HREF="http://www4.ipdl.inpit.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww4.ipdl.inpit.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3C%3D%3D%3C66%3A%2F%2F%2F%26N0001%3D622%26N0552%3D9%26N0553%3D000003"
TARGET="tjitemdrw">drawing 1</A>
is having used the sensibility control circuit 42 instead of the switch 41.
In this case, when the amount of motion detection of the inter-frame motion detecting signals d24 and d35 is large, the gain (sensibility) of the field motion detecting signal d01 is raised, and when the amount of motion detection of the inter-frame motion detecting signals d24 and d35 is small, adjustment control is carried out so that the gain of the field motion detecting signal d01 may be

lowered.
In addition, even when only one side of the inter-frame motion detecting signals d24 and d35 is large, the gain of the field motion detecting signal d01 is raised. When the both sides of the inter-frame motion detecting signals d24 and d35 are small, the gain of the field motion detecting signal d01 is lowered.

[0020]

According to the amount of motion detection of the inter-frame motion detecting signals d24 and d35, adjustable [of the output of the sensibility control circuit 42] is carried out to size accommodative, and it is outputted as motion detecting-signal d01s between the fields.
In the 2nd example, not simple binary control but smoother motion detection is expectable.
In addition, signal d01s here, although signal d01s in
<A
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TARGET="tjitemdrw">drawing 1</A>
is not the same, the same sign is used for convenience.

[0021]

In the 3rd example shown in <3rd example>
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HREF="http://www4.ipdl.inpit.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww4.ipdl.inpit.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3C%3D%3D%3C66%3A%2F%2F%2F%26N0001%3D622%26N0552%3D9%26N0553%3D000006"
TARGET="tjitemdrw">drawing 4</A>
, a different point from
<A
HREF="http://www4.ipdl.inpit.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww4.ipdl.inpit.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3C%3D%3D%3C66%3A%2F%2F%2F%26N0001%3D622%26N0552%3D9%26N0553%3D000003"
TARGET="tjitemdrw">drawing 1</A>
is having formed the perpendicular low pass filter (perpendicular LPF) 33 which can carry out adjustable [of the property of bandwidth] between the subtractor 31 and the absolute-value circuit 32, and having excluded the switch 401.
In the high image part of a perpendicular high-frequency component, the motion detection between the fields has the property of moving also by the stationary part and being easy to be detected.
the mistake was made in so, making perpendicular LPF33 into a narrow-band, and receiving a stationary part, when neither the signal d24 delayed one frame in the inter-frame motion detecting signal d02 nor the signal d35 delayed the 3 fields exists -- he moves and detection should do -- there is nothing -- making .
When a signal d24 and a signal d35 exist, it is made for the motion detection between the fields to become make perpendicular LPF33 a broadband or through, and is easy to be carried out.

[0022]

Also when are done in this way and coincidence of an inter-frame pattern occurs continuously, the motion between the fields to a perpendicular low-pass part can be detected.
By forming perpendicular LPF33 in the preceding paragraph of an absolute-value circuit 32, in case a field motion detecting signal is generated, it becomes possible to adjust the bandwidth exactly.
In addition, signal d01s here, although signal d01s in
<A
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TARGET="tjitemdrw">drawing 1</A>
is not the same, the same sign is used for convenience.

[0023]

In the 4th example shown in <4th example>
<A
HREF="http://www4.ipdl.inpit.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww4.ipdl.inpit.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3C%3D%3D%3C66%3A%2F%2F%2F%26N0001%3D622%26N0552%3D9%26N0553%3D000007"
TARGET="tjitemdrw">drawing 5</A>
, a different point from
<A
HREF="http://www4.ipdl.inpit.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww4.ipdl.inpit.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3C%3D%3D%3C66%3A%2F%2F%2F%26N0001%3D622%26N0552%3D9%26N0553%3D000003"
TARGET="tjitemdrw">drawing 1</A>
is having increased further the delay to the temporal direction of the inter-frame motion detecting signal d02 by forming field memories 26 and 27.
Not only the inter-frame motion detecting signals d24 and d35 but the inter-frame motion detecting signal d46 delayed from the present field three frames and the inter-frame motion detecting signal d57 which carried out 7 field delay are inputted into a switch 41, and on-off control of the switch 41 is carried out to it like
<A
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TARGET="tjitemdrw">drawing 1</A>
.
In the 4th example, also when it generates continuously mostly rather than the case where the part corresponding [a pattern's] shows
<A
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TARGET="tjitemdrw">drawing 2</A>
, a motion can be detected correctly.
Instead of a switch 41, the sensibility control circuit 42 and perpendicular LPF33 may be used.

[0024]

In the 5th example shown in <5th example>
<A
HREF="http://www4.ipdl.inpit.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww4.ipdl.inpit.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3C%3D%3D%3C66%3A%2F%2F%2F%26N0001%3D622%26N0552%3D9%26N0553%3D000008"
TARGET="tjitemdrw">drawing 6</A>
, a different point from
<A
HREF="http://www4.ipdl.inpit.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww4.ipdl.inpit.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3C%3D%3D%3C66%3A%2F%2F%2F%26N0001%3D622%26N0552%3D9%26N0553%3D000003"
TARGET="tjitemdrw">drawing 1</A>
is having considered as the configuration which is made to decrease the output of a field memory 24 with a multiplier (attenuator) 29, and is made to feed back to the maximum detector 28 instead of the series circuit of field memories 24 and 25.
The output of a field memory 23 is inputted into the maximum detector 28 in
<A
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TARGET="tjitemdrw">drawing 6</A>
.
The maximum detector 28 chooses the value of the larger one among the output of a field memory 23, and the output of a multiplier 29, and inputs it into a field memory 24.
Less than one damping coefficient can multiply by the output of a field memory 24,

and it is inputted into the maximum detector 28 by the multiplier 29.
The output of a field memory 24 is used for the on-off control of a switch 41.
Here, a mixing circuit may be used instead of the maximum detector 28.

[0025]

If it does in this way, since a field memory 25 is omissible, it becomes possible to reduce cost.
Like the 4th example of
<A
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TARGET="tjitemdrw">drawing 5</A>
, it is effective for the configuration, then the reduction of field memories like this 5th example, and especially reduction of cost in the configuration using many field memories as a delay means of the inter-frame motion detecting signal d02.
In addition, if the damping coefficient in a multiplier 29 is large, it will be hard coming to decrease the output of a field memory 24, and this will serve as equivalence substantially with what carried out cascade connection of two or more field memories.

[0026]

As mentioned above, it is made to be moved and detected in this invention by using the motion detection between the fields, raising the sensibility, or making a perpendicular band large to the case where there is trace by which the inter-frame motion was detected in the past to the part whose pattern corresponds, by inter-frame [by which an inter-frame motion cannot be detected easily].
On the contrary, it has prevented judging accidentally the stationary part which is easy to cause by the motion detection based on the difference between the fields whose sample points do not correspond as a motion by controlling the motion detection between the fields by information on the motion detection based on inter-frame [past].

[0027]

In this example, the inter-frame motion detecting signals d24, d35, d46, and d57 may be directly generated by delaying the inter-frame motion detecting signal d02 by field memories 23-25, or 23-27, and taking the difference of a signal which was delayed in the image data itself and delayed, although the inter-frame motion detecting signals d24, d35, d46, and d57 used as the control signal of switch 41 grade are generated.
Namely, what is necessary is just to generate the delay inter-frame motion detecting signal which is equivalent to the signal delayed the 1 or more fields in the inter-frame motion detecting signal d02.
In this example, as a desirable operation gestalt, although the inter-frame motion detecting signal d24 delayed one frame and the inter-frame motion detecting signal d35 further delayed the 1 field in this are used, a delay inter-frame motion detecting signal should just be 1 delayed the 1 or more fields in the inter-frame motion detecting signal d02, or two or more signals.

[0028]

All the things that control the motion detection based on the difference between the fields by the signal which this invention is not limited [signal] to the 1st explained above - the 5th example, and delayed one or more motion detecting signals based on inter-frame difference are within the limits of this invention.
In order to raise the precision of motion detection, it is also possible to use combining the motion detector of this invention and other motion detectors.

[0029]

[Effect of the Invention]

As explained to the detail above, the detector of this invention
An inter-frame motion detecting-signal generation means to generate an inter-frame motion detecting signal by taking the 1 inter-frame difference of a video signal,

A field motion detecting-signal generation means to generate a field motion detecting signal by taking the difference between 1 fields of a video signal,
A delay inter-frame motion detecting-signal generation means to generate the delay inter-frame motion detecting signal which is equivalent to the signal delayed one or more frames in the direction of time amount in an inter-frame motion detecting signal,
A motion detecting-signal generation means to generate a final motion detecting signal using an inter-frame motion detecting signal and a field motion detecting signal at least,
a ****** [using a field motion detecting signal based on a delay inter-frame motion detecting signal] -- or
Since the control means which controls extent using a field motion detecting signal was had and constituted, the stationary part which can detect a motion of the image whose pattern corresponds by inter-frame, and has a perpendicular high-frequency component cannot be judged accidentally to be a motion, and a motion can be detected correctly.

<HR>DESCRIPTION OF DRAWINGS
<HR>[Brief Description of the Drawings]

<A
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TARGET="tjitemdrw">[Drawing 1]</A>

It is the block diagram showing the 1st example of this invention.

<A
HREF="http://www4.ipdl.inpit.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww4.ipdl.inpit.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3C%3D%3D%3C66%3A%2F%2F%2F%26N0001%3D622%26N0552%3D9%26N0553%3D000004"
TARGET="tjitemdrw">[Drawing 2]</A>

It is drawing for explaining actuation of this invention.

<A
HREF="http://www4.ipdl.inpit.go.jp/cgi-bin/tran_web_cgi_ejje?u=http%3A%2F%2Fwww4.ipdl.inpit.go.jp%2FTokujitu%2Ftjitemdrw.ipdl%3FN0000%3D237%26N0500%3D1E%5FN%2F%3B%3E%3C%3D%3D%3C66%3A%2F%2F%2F%26N0001%3D622%26N0552%3D9%26N0553%3D000005"
TARGET="tjitemdrw">[Drawing 3]</A>

It is the block diagram showing the 2nd example of this invention.

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TARGET="tjitemdrw">[Drawing 4]</A>

It is the block diagram showing the 3rd example of this invention.

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TARGET="tjitemdrw">[Drawing 5]</A>

It is the block diagram showing the 4th example of this invention.

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TARGET="tjitemdrw">[Drawing 6]</A>

It is the block diagram showing the 5th example of this invention.

[Description of Notations]

11, 12, 23-27 Field memory

13 Rhine Memory

14 Average Circuit

21 31 Subtractor

22 32 Absolute-value circuit

28 Maximum Detector

29 Multiplier (Attenuator)

33 Perpendicular Low Pass Filter

41 Switch

42 Sensibility Control Circuit

51 Maximum Detector (Motion Detecting-Signal Generation Means)

<HR></BODY></HTML>